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PROJET DE DEVELOPPEMENT URBAIN INTEGRE ET DE RESILIENCE  
(PRODUIR)

ETUDE D'IMPACT ENVIRONNEMENTAL ET SOCIAL (EIES)  
SITE DE CONFINEMENT DES BOUES DE CURAGE

**Rapport Final**

**Mars 2019**

# SUMMARY

## 1. Project and survey context

The project is an operation of sewage sludge evacuation to a confinement site. It is about developing the containment area in the Rural Commune of Iarinarivo, carrying the sewage sludge from the C3 canal to the containment area, using the containment area for dredging purposes, and rehabilitating the site after the operational activities (at the end of dredging).

Within the framework of this project, a survey on the environmental and social impact (EIES) has been carried out and has been the object of an EIES report, synthesised by this summary and following the national regulations.

The EIES was carried out by Artelia Madagascar according to the directives and the requirements of The Environment and Investment Bookkeeping decree (Décret MECIE). The environmental and social investigations took place in the survey area in November 2018

The EIES report has eight chapters and is organised as follows:

- Chapter 1: Introduction
- Chapter 2: Regulatory Framework
- Chapter 3: Description of the Project
- Chapter 4: Description of the receiving environment
- Chapter 5: Impact assessment and mitigations measures
- Chapter 6: Risks and dangers assessment
- Chapter 7: Environmental and social management plan (PGES)
- Chapter 8: Public consultation

## 2. Regulatory framework

All the regulatory texts applicable to the sewage sludge containment project have been analyzed as part of the ESIA. They are categorized as follows:

- National regulatory framework (Constitution of the Republic of Madagascar, Environmental Charter, MECIE decree, regulation on public participation in environmental assessment);
- Sectoral regulations (town planning, land, expropriation, sensitive areas, water code, health code, pollution, discharge standards, spills, heritage protection, road charter, labor code);
- International conventions (environmental agreements ratified by Madagascar and applicable to the project);
- World Bank safeguard policies (safeguard policies triggered for the project case).

## 3. Project description

An analysis of sludges from the C3 channel in 2017 made it possible to characterize the quality of the sludge to be cured, as summarized in the table below:

## Non technical summary

Paramètre analysé	Unité	1	2	3	4	5	6	7	8	Valeur Seuil protocole H14
Aluminium (Al)	mg/kg MS	37 000	24 000	27 000	24 000	50 000	23 000	18 000	18 000	
Chrome (Cr)	mg/kg MS	49	35	51	35	47	38	34	31	150
Manganèse (Mn)	mg/kg MS	130	140	130	140	160	190	200	270	
Fer (Fe)	mg/kg MS	21 000	18 000	23 000	17 000	28 000	19 000	19 000	19 000	
Cobalt (Co)	mg/kg MS	5	5	5	5	6	6	6	6	
Nickel (Ni)	mg/kg MS	15	15	17	14	14	17	15	15	50
Cuivre (Cu)	mg/kg MS	28	32	39	42	28	45	39	54	100
Zinc (Zn)	mg/kg MS	110	180	180	190	170	260	290	350	300
Arsenic (As)	mg/kg MS	<2,0	<2,0	<2,0	<2,0	<2,0	<2,0	<2,0	<2,0	30
Sélénium (Se)	mg/kg MS	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	
Molybdène (Mo)	mg/kg MS	<10	<10	<10	<10	<10	<10	<10	<10	
Argent (Ag)	mg/kg MS	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	0,6	0,7	
Cadmium (Cd)	mg/kg MS	<0,5	0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	2
Étain (Sn)	mg/kg MS	4	3	2	3	3	4	3	6	
Antimoine (Sb)	mg/kg MS	<10	<10	<10	<10	<10	<10	<10	<10	
Baryum (Ba)	mg/kg MS	190	180	170	190	210	230	260	230	
Mercure (Hg)	mg/kg MS	0,1	0,2	0,1	0,2	0,2	0,2	0,2	0,2	1
Plomb (Pb)	mg/kg MS	49	140	49	69	96	350	190	98	100
Paramètre analysé	Unité	9	10	11	12	13	14	15	16	Valeur Seuil protocole H14
Aluminium (Al)	mg/kg MS	21 000	11 000	13 000	12 000	18 000	7 200	15 000	30 000	
Chrome (Cr)	mg/kg MS	48	26	34	42	8	25	27	35	150
Manganèse (Mn)	mg/kg MS	260	140	140	160	120	73	98	270	
Fer (Fe)	mg/kg MS	27 000	24 000	19 000	20 000	28 000	17 000	13 000	21 000	
Cobalt (Co)	mg/kg MS	9	5	5	5	4	3	4	6	
Nickel (Ni)	mg/kg MS	29	12	14	12	5	8	11	13	50
Cuivre (Cu)	mg/kg MS	120	21	30	27	7	11	26	24	100
Zinc (Zn)	mg/kg MS	720	170	310	350	45	69	130	140	300
Arsenic (As)	mg/kg MS	2	<2,0	<2,0	<2,0	<2,0	<2,0	<2,0	<2,0	30
Sélénium (Se)	mg/kg MS	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	<5,0	
Molybdène (Mo)	mg/kg MS	<10	<10	<10	<10	<10	<10	<10	<10	
Argent (Ag)	mg/kg MS	1,3	<0,5	0,7	0,5	<0,5	<0,5	<0,5	<0,5	
Cadmium (Cd)	mg/kg MS	1,2	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	<0,5	2
Étain (Sn)	mg/kg MS	10	2	3	3	<2,0	<2,0	2	3	
Antimoine (Sb)	mg/kg MS	<10	<10	<10	<10	<10	<10	<10	<10	
Baryum (Ba)	mg/kg MS	370	150	180	170	120	64	150	440	
Mercure (Hg)	mg/kg MS	0,5	0,1	0,3	0,2	<0,1	<0,1	0,1	0,2	1
Plomb (Pb)	mg/kg MS	160	81	61	78	21	21	42	54	100

Source: BRL, 2018. PRODUIR. EIES des travaux de remise en état des infrastructures de drainage et de protection contre les inondations. AGETIPA.

The physico-chemical characteristics of the sediments has shown that their reuse or incineration are not technically and / or economically relevant. The PRODUIR project has therefore studied various solutions for the containment of these sludge, either in landfill (in this case the Andralanitra landfill) or on an alternative site. The study of the sludge disposal variant to the Andralanitra landfill was considered difficult to implement because it would reduce by 2 years the life of the landfill that is currently used for the whole of the agglomeration of Antananarivo; moreover, it does not allow a specific management of the effluents resulting from the sewage sludge stored, taking into account the existing configuration of the Andralanitra site.

Thus, the PRODUIR project has turned to the option of evacuation of sludge from an alternative site dedicated to their containment, the implementation of which is more controllable in technical, environmental and social terms. And after a pre-identification and site selection process, the Iarinarivo site was selected for the construction of the C3 sludge containment site, which will represent a total volume of 115,000 m<sup>3</sup>.

The containment area of the cleaning mud includes the following work:

- Excavation of 46 300 m<sup>3</sup> to have a capacity of 129 500 m<sup>3</sup> for the storage of 115 000 m<sup>3</sup> of dredging material
- Development of a 3 m high peripheral;
- Creation of an operating track with a width of 3 m;
- Creation of rainwater collection ditch;

## Non technical summary

- Setting up a fence around the site;
- Deviation of the existing public runway 360 m north of the site;
- Construction of storage basin for waterways and of water treatment facilities (filter, macrophyte bed, mound system);
- Installing a final cover after work on the site is done;
- Post operation development.

The transportation of the 115 000 m<sup>3</sup> of sewage sludge from the cleaning work site through the canal C3 till the confinement site of the products is equally part of the project.

The containment site will be fenced and secured. It will be forbidden to access people outside the project.

In addition, the post operation development and closure of the site will be studied during the project's phase of detailed technical studies. The corresponding arrangements must ensure the securing and protection of the containment site beyond the operating time of the site.

## 4. Description of the receiving environment

The containment site is in the Fokontany of Amboasary in the Commune of Iarinarivo, district of Ambohidratrimo, Region of Analamanga. The main road for the transport of the sewage sludge, from the canal C3 till the containment site, goes through the Urban Commune of Antananarivo as well as the communes of Ambohitrimanjaka and Iarinarivo in the Region of Analamanga.

The geomorphology of the survey area is composed of a succession of valleys and hills with rounded peaks. The latter is surrounded by ricefields. The higher you go towards the hill peaks, farming fields, houses and small tracks can be noted. There is no water network in the vicinity of the operation site.

As far as climate is concerned; the survey area has a warm tropical climate. The rainy season starts in October and finishes mid-April; whereas the windy season is between June and October.

Biologically, the confinement site is on flat land, with some woody elements bordering Southwest, North and East. These woody elements are composed of *Eucalyptus robusta*, *Barleria prionitis*, *Pinus* and *Syzygium cumini*. Only part of the site is colonized by grassy vegetation dominated by *Aristida congesta* (excavated area and its immediate surroundings). The height of the individuals does not exceed 5cm, probably due to grazing by zebus and frequent brushing of the site. The recovery of the latter is about 30% of the site.

All around the area, grazing remains colonised by savanna species (*Aristida congesta*) have been transformed into crop fields. The lower parts near the rice fields are used for market garden crops. Nevertheless, a few fruit trees such as *Syzygium cumini* and *Mangifera indica* were seen in most of the shallows near the containment site.

The rural Commune of Iarinarivo covers an area of about 24,5km<sup>2</sup>, with a total population of 12,000 inhabitants spread over 10 fokontany.

The containment site is in the Amboasary fokontany, in the Amboasary sector, near the locality called "Ambohibola". The fokontany of Amboasary has 850 inhabitants in 150 households. This represents about 7% of the total population of the Commune of Iarinarivo.

Representing 95% of all practices, agriculture is the most important economic activity in the fokontany of Amboasary. The main crops grown are: first-season rice, tomatoes, potatoes, beans, cassava, sugar cane and some off-season crops. Livestock is concentrated on zebu, pork and poultry. Fish farming also exists in the fokontany.

As with the Amboasary fokontany in general, the activities of the population in the target area mainly concern agriculture. Households in the target area grow first-season rice, tomato, beans, maize, cassava, potatoes, green leaves. These crops are usually grown during the rainy season, except for cassava and green leaves, which are grown in all seasons. These households also raise zebus, pigs or poultry. Off-season crop production is intended for sale at the markets of Ambohidratrimo or Talatamaty. There are also sometimes collectors who get the products directly locally.

About 15 households are identified in the target area (implantation area of the sludge containment site), representing just over 50 people. Their properties are in the vicinity of the former borrow pit, some of which are cultivated lands directly affected by the containment site right-of-way. On the other hand, no dwelling place is affected by the project. A typical household in the target area is composed of 2 to 5 people. The profiles are very varied, and they are mostly couples with children or without children, and a retired couple with their children. Among these inhabitants, some are settled in the area since 25 to 30 years ago, others for only 4 years. They all declare to own their land.

## 5. Potential impacts and mitigation measures

The identification of potential impacts is done by crossing the project components with those of the receiving environment. The following table presents the planned activities for each phase of the Project and the corresponding potential impacts.

*Identification of potential impacts at each operation phase*

ORIGINS OF THE IMPACTS	POTENTIAL IMPACTS
<b>Acquisition of the site for the project</b>	Degradation of local landscape quality. Loss of values of land and adjacent dwelling places. Risks of land conflicts associated with the limits of the project footprint. Loss of land exploited / valued or not.
<b>Works Phase</b>	
Site installation & life base	Temporary loss of land, risk of conflict. Loss of vegetation and natural habitat by clearing. Pollution of the surrounding environment by waste and waste generated by the site installation. Risk of accidental oil spill. Uncontrolled development of informal activities by the arrival of people around the area of installation of site. Health risks (diseases, ...).
Excavation works	Nuisances for residents (noise, dust). Loss of vegetation and natural habitat by clearing. Risk of accidents for staff and residents. Bury crop fields adjacent to the site to be excavated. Fortuitous discovery of cultural property
Transport to and from the works site	Nuisances for the residents of the routes borrowed (noise, dust). Degradation of air quality (GHG emissions). Disturbances for users of the borrowed route, risk of congestion of traffic. Risk of accidents for local residents and road users. Degradation of the state of the road.
Use of labour outside the works area	Real or perceived disruption of normal community life related to the physical presence of labour. Risk of insecurity associated with the increase in the number of people attending the area daily. Risk of frustration of the local community through the use of labour outside the area
Dismantling of the work installations	Leaching of unprotected surfaces and risk of erosion, runoff loaded with solids that can silt up the downstream bottomlands
<b>Operation phase</b>	
Presence of the containment site and on-site activities	Visual embarrassment for immediate residents.
Transport of sewage sludge to the containment site	Nuisances for the residents of the routes borrowed (noise, dust, odours). Health risks through product losses along the route. Degradation of air quality (GHG emissions). Disturbances for users of the borrowed route, risk of congestion of traffic. Risk of accidents for local residents and road users. Degradation of the state of the road.

<i>ORIGINS OF THE IMPACTS</i>	<i>POTENTIAL IMPACTS</i>
Operations of the containment site	Nuisances for residents (noise, dust, odours). Risk of accidents for staff and local populations. Soil and groundwater pollution from percolation waterways from stored sludge.
<b>Post-exploitation phase</b>	
Final site cover and post-development development work	Nuisances for residents (noise, dust). Risk of accidents for the staff and the local populations.
Presence of the redeveloped area	Loss of initial land use. Risk of frustration of the population if the site does not fit their expectations.

Mitigation measures were then proposed. They are structured through the project's Environmental and Social Management Plan (ESMP) and should be used to manage the impacts of the project if they are actually implemented.

## 6. Risk analysis

This part of the ESIA report consisted of the identification of risks and dangers, then the definition of measures to control these risks and dangers. The objective is to anticipate the possibilities of emergency cases, and to be able to implement the corresponding actions in case of real event.

The types of risks and the corresponding measures were thus identified for the following risks: fire and explosion; electrical hazards; risks associated with heavy-duty vehicles; noises and vibrations; falls of people; manual and non-manual handling; collapses and falling objects; risks related to traffic and movement; dangers related to diesel.

## 7. Project's Environmental and Social Management Plan (ESMP)

The Environmental and Social Management Plan (ESMP) is the basis for the environmental and social management of the project for the development and operation of cleaning sludge of the containment site at Iarinarivo. It describes the measures that must be put in place before, during and after the works to minimize or eliminate the negative impacts of the project identified during the project impact assessment.

The formal ESMP programs of the project include:

- The program of implementation of the mitigation measures,
- The environmental monitoring program,
- The environmental follow-up program,
- The capacity building program.

In addition, the main lines of specific plans relating to thematic procedures for environmental and social management were also attached to the ESMP.

### Mitigation Implementation Program

The mitigation implementation program consists of the following three main plans:

- Concerning the environment: measures for clearing management, measures for the management of the operation and protection of work sites, measures for the management of waste generated by project activities, measures with respect to the transport of sludge cleaning up to the containment site, repairs for the restoration of work sites;
- At the social level: information, communication and awareness, complaints management, local recruitment during the works, social integration measures for the project in its initial environment.

### Environmental Surveillance Program

The goal of environmental monitoring is to ensure that all mitigation and monitoring measures proposed as part of the project's Environmental and Social Management Plan are implemented effectively.

At each phase of the project, there are mitigation measures, indicators to be monitored and those responsible for implementing and monitoring the implementation of the measures.

## **Environmental Monitoring Program**

The Environmental Monitoring Program (ESP) includes the following monitoring activities: Follow-up of the release of rights of way, follow-up of the cleared surfaces, monitoring of solid and liquid waste, monitoring of the water quality around the project site, follow-up of accidental spills, monitoring of local recruitment, monitoring of the state of public roads used, monitoring of rehabilitated sites, monitoring of air quality, monitoring of the state of habitations located near the site, monitoring of the quality of effluents discharged after treatment.

## **Capacity Building Program**

The Capacity Building Program includes the following activities: Training of environmental and social safeguard managers of the Project Management Unit in environmental and social project management and project implementation; Training of local officials (Municipality of Iarinarivo and Fokontany Amboasary) on the environmental and social issues associated with a sediment storage center, and in the monitoring of the implementation of the ESMP by the project; Training of the company concerned for the implementation of environmental and social measures during the operation of the containment site.

## **8. Conduct of public consultations**

Consultations during the field investigations consisted of conducting interviews with the various people living / working around the project site, with particular knowledge of the area. The main points raised by the interlocutors during the interviews concerned the following aspects:

- The more precise explanations concerning the consistency of the project in general and the reason for its realization;
- Fear of some people around the site to be forced to leave their properties;
- The impacts of sludge cleaning on the health of the inhabitants around the confinement site;
- Request not to leave the sludge in the open air while filling the containment site, but to backfill over and above the sludge;
- More precise explanations concerning the future of the site and its post-work use;
- Compensation to be made if land belonging to these people will be affected by the project.

A public information meeting was also organized on December 4, 2018. This public meeting enabled us to present the context and the consistency of the C3 canal cleaning sludge containment project to the local population. The consistency of the Consultant's mission was also developed, namely the preparation of the Environmental and Social Impact Assessment (EIES) of the project and the development of the corresponding Resettlement Action Plan (RAP). About 30 people attended the meeting was, including more than 50% pre-identified PAPs. The main concerns and suggestions of the participants, relating to the project of sewage sludge containment site in Iarinarivo concerned the compensation aspects of the people affected by the project.

As part of the finalization of the ESIA, a public consultation meeting was also organized on 25 February 2019 during which details on the project, the final footprint, the results of the ESIA and the potential impacts identified with the corresponding measures have been presented. About thirty people attended the meeting. The main concerns and suggestions of the participants, relating to the project of sewage sludge containment site in Iarinarivo concerned the identification of the plots affected by the project footprint and the aspects of compensation by the loss of these lands.

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